METEORITES FROM ANTARCTICA (EXTENDED ABSTRACT)

Keizo YANAI

National Institute of Polar Research, 9–10, Kaga 1-chome, Itabashi-ku, Tokyo 173

The first Antarctic meteorite was recovered in 1912 by Australasian Antarctic Expedition led by Douglas MAWSON (BAYLY and STILLWELL, 1923). The total number of finds up to 1969 over the entire continent was only four, which consisted of six pieces (BAYLY and STILLWELL, 1923; HEY, 1966; FORD *et al.*, 1971). Since 1969, over 1000 meteorite pieces later named Yamato meteorites have been recovered by the Japanese Antarctic Research Expedition in an area near the Yamato Mountains, Queen Maud Land, later designated as the Meteorite Ice Field (YOSHIDA *et al.*, 1971; KUSUNOKI, 1975; SHIRAISHI *et al.*, 1976; YANAI, 1976, 1978a; MATSUMOTO, 1977, 1978), and over 300 pieces named Allan Hills meteorites were recovered

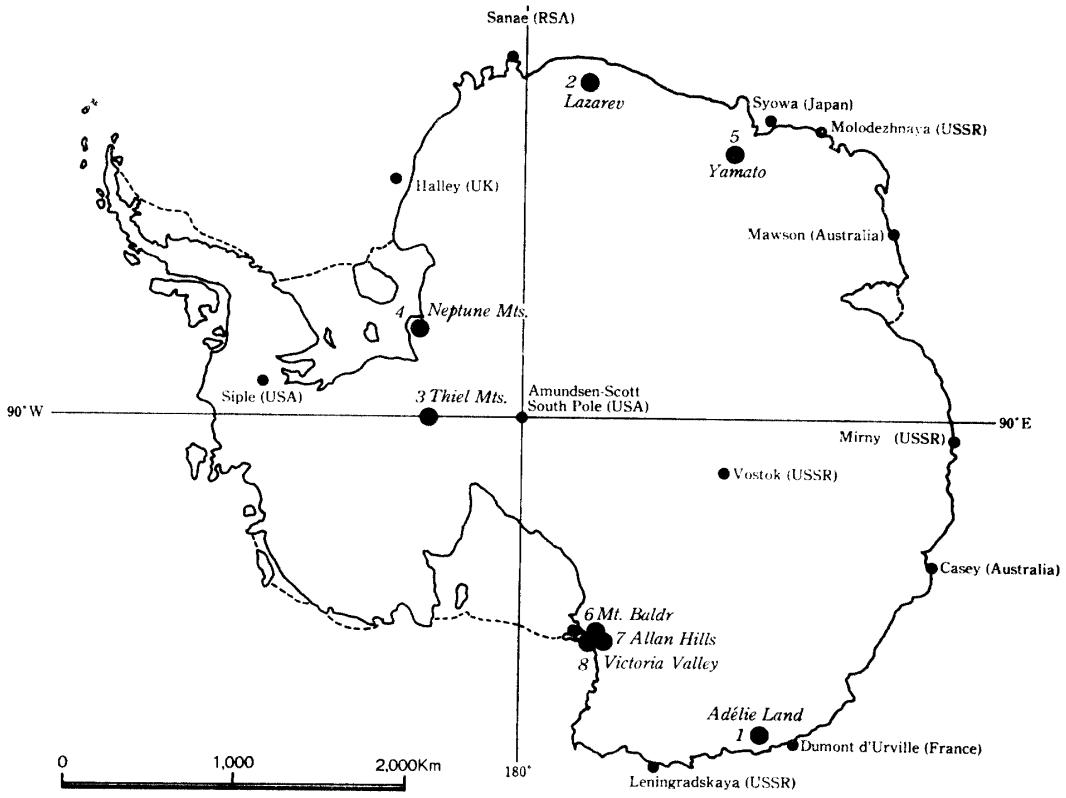

Fig. 1. Localities of Antarctic meteorites.

by a joint U. S. -Japan team in the Allan Hills, South Victoria Land (CASSIDY *et al.*, 1977; YANAI, 1978b, 1979; YANAI *et al.*, 1979). As shown in Fig. 1 Antarctic meteorites were found at eight localities until 1978.

Fig. 2. Bare ice field near Allan Hills, South Victoria Land, viewed from the south in January 1978.

It seems that Antarctic meteorites have been protected from chemical and biological contamination, because they have been kept very cold and in contamination-free environments. Therefore Antarctic meteorites are considered to be scientifically very important materials.

Most of Yamato and Allan Hills meteorites were found sitting just on the surface of bare ice (Fig. 2) after ablation of ice sheet, but a few were found on the surface of thin firn on the bare ice and only two were found buried in the bare ice. A typical scene of meteorite-collected field is shown in Fig. 2. Most of the Antarctic meteorites are almost entirely covered with a fusion crust and some broken ones are also partially covered with them. Generally the crust of the stony meteorites were abraded partially by weathering, therefore sometimes chondrules were shown on the broken surface. Iron meteorites were characterized by exhibiting a spherical shape with fused surface and thumb-prints as shown in Fig. 3.

Most of the small specimens show fragmental shape and majority of them are oxidized deeply showing brown color. It is not sure whether the fragmentation had occurred when the larger meteorites dashed into the errth's atmosphere or impacted the earth's surface or by mechanical breaking on the bare ice after their fall. Some meteorites are considered to be landed softly onto the deep and soft snow in the

interior of Antarctica, because most of them are completely covered with a fusion crust.

Fig. 3. An iron meteorite found at Allan Hills, South Victoria Land, January 1978.

Table 1. Antarctic meteorites found during 1912–1978.

	Name	Type	Number	Weight (kg)	Latitude	Longitude	Date of find	Remarks
1	Adélie Land	Chondrite	1	1.021	67°11′ S	142°23′ E	Dec. 1912	On snow
2	Lazarev	Iron	2	10	71°57′ S	11°30′ E	Jan. 1961	In rocky area
3	Thiel Mountains	Pallasite	2	28.6	85°23.9′W	86°35.4′W	Dec. 1961	On ice and in morainal debris
4	Neptune Mountains	Iron	1	1.070	83°15′ S	55°W	Feb. 1964	
5	Yamato	Chondrite in majority	991	*ca.* 100	71°-73° S	34°50′-37° E	Dec. 1969 Dec. 1973 Nov. to Dec. 1974 Nov. 1975 to Jan. 1976	On ice, in ice and on firn
6	Mount Baldr	Chondrite	2	17.890	77°37′ S	160°20′ E	Dec. 1976	On ice
7	Allan Hills	Chondrite in majority	354	*ca.* 600	76°45′ S	159°20′ E	Jan. 1977 Dec. 1977 to Jan. 1978	On ice, in ice, on firn and in moraine
8	Victoria Valley	Iron	1	19.068	77°22′ S	162°18′ E	Jan. 1978	In moraine
	Total		1354	777 kg				

Table 2. Kinds and numbers of Antarctic meteorites.

		Irons	Pallasites	Carbonaceous chondrites	Diogenites	Ureilite	Eucrites	Howardites	Chondrite	?	Total
1	Adélie Land 1912								1		1
2	Lazarev 1961	2									2
3	Thiel Mts. 1961		2								2
4	Neptune Mts. 1964	1									1
5	Yamato 1969			1	1				7		9
	1973							1	11		12
	1974		1	3	22	3	3		631		663
	1975–76	2		3	7		5		290		307
6	Mt. Baldr 1976								2		2
7	Allan 1977	1					1		41		43
	Hills 1977–78	6		2	1+(1)	1	1		295	4	311
8	Victoria Valley 1978	1									1
	Total	13	3	9	31+(1)	4	10	1	1278	4	1354

To date, meteorites collected from Antarctica included 13 irons, 3 pallasites, 9 carbonaceous chondrites comprising three type-II and one type-III, 32 diogenites, 4 ureilites, 10 eucrites, 1 howardite, and many chondrites of varying types and petrological grades, in which may contain some very rare specimens. Summary of the locations and date of finds, field occurrences, classifications and the numbers of the Antarctic meteorites is described in Tables 1 and 2.

It is possible that Antarctica contains many more specimens as yet undiscovered. For example, a calculation by the present author (YANAI, 1978a) based on the Yamato finds predicts that over 7000 specimens are still to be discovered in Antarctica which is really deep-freeze storehouse for meteorites.

References

BAYLY, P. G. W. and STILLWELL, F. L. (1923): The Adélie Land meteorites. Australas. Antarct. Exped., 1911–1914, Sci. Rep., Ser. A, **4**, 1–11.

CASSIDY, W. A., OLSEN, E. and YANAI, K. (1977): Antarctica: Deep-freezed storehouse for meteorites. Science, **198**, 727–731.

FORD, A. B. and TABOR, R. W. (1971): The Thiel Moutains pallasite of Antarctica. U. S. Geol. Surv. Prof. Paper, **750** D, D56–D60.

HEY, M. H. (1966): Catalogue of Meteorites, 3rd ed. London, The British Museum (Natural History), 637 p.

KUSUNOKI, K. (1975): A note on the Yamato meteorites collected in December 1969. Mem. Natl Inst. Polar Res., Spec. Issue, **5**, 1–8.

MATSUMOTO, Y. (1977): Yamato inseki no shûseki ni tsuite (On concentration of Yamato-75 meteorites). Dai-2-kai Yamato Inseki Shinpojiumu Yokôshû (Astr. 2nd Symp. Yamato Meteorites). Tokyo, Natl Inst. Polar Res., 4–6.

MATSUMOTO, Y. (1978): Collection of Yamato meteorites, East Antarctica in November and December 1975, and January 1976. Mem. Natl Inst. Polar Res., Spec. Issue, **8**, 35–50.

SHIRAISHI, K., NARUSE, R. and KUSUNOKI, K. (1976): Collection of Yamato meteorites, Antarctica, in December 1973. Nankyoku Shiryô (Antarct. Rec.), **55**, 49–60.

YANAI, K. (1976): 1974-nen no nankyoku-san inseki no tansa to saishû (Search and collection of Yamato meteorites, Antarctica, in November and December 1974). Nankyoku Shiryô (Antarct. Rec.), **56**, 70–81.

YANAI, K. (1978a): Yamato meteorites collection, Antarctica from November to December 1974. Mem. Natl Inst. Polar Res., Spec. Issue, **8**, 1–37.

YANAI, K. (1978b): First meteorites found in Victoria Land, Antarctica, December 1976 and January 1977–Report of U. S.-Japan joint program titled "Antarctic Search for Meteorites" 1976–1977. Mem. Natl Inst. Polar Res., Spec. Issue, **8**, 51–69.

YANAI, K. (1979): Meteorites search in Victoria Land, Antarctica in 1977–1978 austral summer. Mem. Natl Inst. Polar Res., Spec. Issue, **12**, 1–8.

YANAI, K., CASSIDY, W. A., FUNAKI, M. and GLASS, B. P. (1979): Meteorite recoveries in Antarctica during field season 1977–1978. Proc. Lunar Planet. Sci. Conf. 9th, 977–987.

YOSHIDA, M., ANDO, H., OMOTO, K., NARUSE, R. and AGETA, Y. (1971): Discovery of meteorites near Yamato Mountains, East Antarctica. Nankyoku Shiryô (Antarct. Rec.), **39**, 62–65.

(Received November 20, 1978; Revised manuscript received May 10, 1979)